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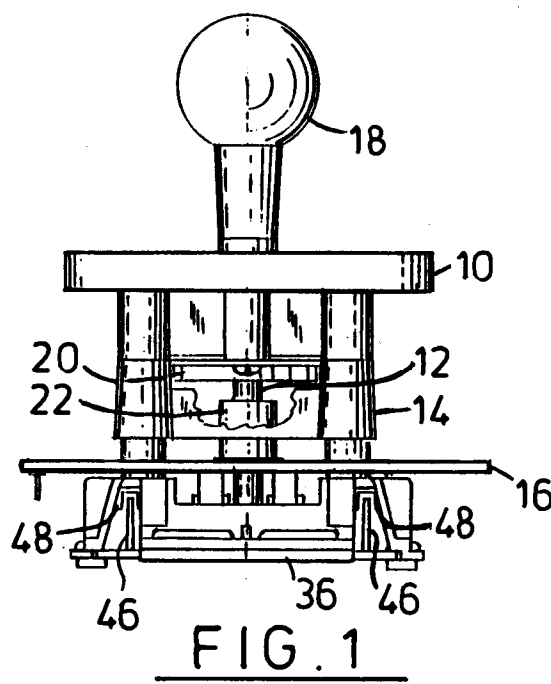
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Manchester M3 3JY(GB)(54) **Improved optical dual-function joystick for electronic games.**

(57) An optical multi-function joystick for electronic video games employs a simple slot-in-groove arrangement to allow movement in perpendicular directions of slidable members, which carry fins to interrupt light beams produced by opto-sensors. A control shaft (12), which moves the slidable members, is retained for pivotal movement in the joystick frame.



BACKGROUND OF THE INVENTION

The present invention relates generally to electronic video games, and more particularly to joystick controls for such games.

Joysticks are well known in the art and are particularly suited to control or direct two-dimensional movement of an image on a video screen. The prior art teaches the use of an optical mask arrangement for converting the joystick position into a digital format for use by a microprocessor that controls operation of the video game. These joysticks are ideally suited for controlling two separate functions of image movement, such as direction of movement and velocity. An optical, dual function joystick of this type is described in U. S. Patent 4,856,785 ("the Lantz patent"), which is hereby incorporated by reference.

The joystick design disclosed in the Lantz patent employs a costly specialized plate assembly to support slidable members, which carry fins to interrupt the light beams produced by opto-sensors. Also, the structure that communicates joystick movement to the opto-sensors requires several small mechanical parts which must be assembled in a confined area. Specifically, the slidable members are mounted on posts and are secured by several "C"-rings and washers, which must be individually installed.

Furthermore, the joystick described in the Lantz patent employs an elaborate elastomeric centering member secured by "C"-rings to four posts on the bottom of the specialized plate assembly. The joystick control shaft is retained in a metal hub, which is separately mounted to the frame. The hub contains a swivel bearing to allow pivotal motion of the joystick. An improved joystick design having the reliability of the joystick described in the Lantz patent, while being easily and inexpensively manufactured, is desirable.

Accordingly, it is an object of the present invention to provide an optical, dual function joystick that is rugged in construction and reliable in operation.

It is a further object of the invention to provide such a joystick that may be manufactured more easily and inexpensively than conventional joysticks.

These objects, as well as others, will become apparent to those skilled in the art from the detailed description of the invention provided below.

SUMMARY OF THE INVENTION

The joystick of the present invention is of rugged, durable construction, but can be manufactured more easily and inexpensively than conventional joysticks embodying similar opto-sensor technol-

ogy. These advantages are obtained by simplifying the design of the structure used to communicate joystick movement to the opto-sensors. Specifically, the present joystick employs an elastomeric grommet to support a control shaft, which includes a user-operated handle. The grommet biases the shaft toward a neutral center position when no external force is applied. When the handle of the control shaft is operated by the video game player, the distal end of the shaft moves two slidable members, which are mounted to the lower portion of a joystick frame for movement in perpendicular directions. The slidable members carry optical blocking fins, which interrupt the light beams produced by the opto-sensors. When the slidable members are moved by the control shaft, the fins create a unique pattern for each discrete joystick position. The opto-sensors transmit a corresponding digital code for use by the video game microprocessor.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of one embodiment of the present invention.

FIG. 2 is a bottom view of the same embodiment shown in FIG. 1.

FIG. 3 is an exploded view showing the relationship of the slidable members to the carriage.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to the drawings, a preferred embodiment of the present invention is shown in FIG. 1. A rectangular frame 10 is provided to support the joystick assembly. In a preferred embodiment, the frame is plastic. The frame has a central aperture to receive a control shaft 12 therein.

A lower stop 14 is secured to the end of the frame 10. The lower stop 14 separates the frame 10 from an electronic circuit board 16. The circuit board 16, mounts optical sensor elements (to be described) and other electronic components. The lower stop 14 and the circuit board 16 also have central apertures to accommodate passage of the control shaft 12.

The control shaft 12, which has a user-operated handle 18 fixedly secured to one end thereof, is mounted for multidirectional pivotal movement relative to the frame 10. The control shaft 12 is secured to the frame via a substantially annular elastomeric grommet 20. The grommet 20 biases the control shaft 12 to a neutral center position. The control shaft 12 then passes through a plastic spacer 22, which is concentrically disposed within the aperture in the lower stop 14. The spacer 22 limits the maximum displacement of the control

shaft 12 by butting against the edge of the aperture in the lower stop 14. Thus, maximum control shaft displacement can be altered by changing the outer diameter of the spacer. The spacer 22, is held in place by a "C"-ring 24, which is secured in a circumferential groove on the control shaft 12. Finally, the distal end of the control shaft 12 passes through elongated apertures 26, 28 in two rectangular, orthogonally disposed, slidable members 30, 32.

The construction and arrangement of the slidable members 30, 32 can be clearly seen in FIG. 2 and FIG. 3. A carriage 33, having carriage supports 34, 36 is secured to the bottom of the electronic circuit board 16. The carriage supports 34, 36 each contain a pair of grooves 38, 40 for retaining the two slidable members 30, 32. Slidable member 30 is disposed for sliding motion in grooves 38 located in the carriage support 34. Slidable member 32 is disposed for sliding motion in grooves 40 located in the carriage support 36. The grooves 38 in the carriage support 34 are disposed so that the plane in which slidable member 30 travels is slightly above, and substantially parallel to the plane of travel of slidable member 32. Thus, the slidable members do not interfere with each other. The slidable member 30 is moved in either direction shown by arrow 42, in response to a movement of handle 18 in the opposite direction. Similarly, arrow 44 indicates the directions of movement of slidable member 32.

It should be noted that the control shaft, when moved in either direction indicated by arrow 42, will cause movement of slidable member 30 along the same axis, but will not disturb the location of slidable member 32. The control shaft will merely move within the confines of oval-shaped aperture 28. Similarly, when the control shaft is moved in either direction indicated by arrow 44, slidable member 32 will be repositioned and slidable member 30 will remain stationary. Movement of the control shaft in any direction other than the orthogonal directions shown by arrows 42 and 44 will cause both slidable members to be moved simultaneously.

A plurality of optical blocking fins 46 are fixedly mounted on slidable members 30, 32. In the disclosed embodiment, two fins are disposed substantially near each end of the upper surfaces of the slidable members 30, 32. Each fin 46 is associated with a corresponding opto-switch 48 disposed on the circuit board 16. The fins 46 sequentially block and unblock the opto-switches 48 depending on the direction and magnitude of movement of the joystick. Each position of the joystick corresponds to a unique digital output code generated by the opto-switches 48 to the controlling microprocessor of the video game. This information is used by the microprocessor to determine the flow of the game's

computer program. The use of digital codes from opto-switches associated with the joystick is described more fully in the Lantz patent.

The design of the present joystick allows easy, inexpensive manufacture. As illustrated in FIG. 3, the slidable members 30, 32 are easily positioned in their respective grooves in the carriage supports 34, 36 during assembly. The present joystick also employs a simple annular elastomeric grommet, which is secured directly to the frame 10 during assembly, to bias the control shaft 12 to centered position. The grommet also assists in retaining the control shaft 12 in the frame 10, eliminating the need for additional means to support the shaft. Thus, the design improvements embodied in the present joystick allow easy, efficient assembly, while reducing per unit material and assembly costs.

In operation, the game player moves the handle 18 to effect movement of a screen image. The movement of handle 18 is transmitted to the slidable members 30, 32 by the control shaft 12. Control shaft 12 displaces either or both of the slidable members 30, 32, resulting in the generation of a unique joystick position code by the opto-switches 48. Circuitry similar to that disclosed in the Lantz patent is used to transmit the unique joystick position code to the controlling microprocessor. The microprocessor uses the positioning information to make calculations according to algorithms contained in the game's software program. Upon completion of these calculations, the video screen is updated to reflect the result of the player's movement of the joystick. This process is repeated several times per second. If the player ceases to operate the joystick at any time, the elastomeric grommet 20 biases the control shaft 12 to its neutral center position.

The present invention has been described with respect to certain embodiments and conditions, which are not meant to limit the invention. Those skilled in the art will understand that variations from the embodiments and conditions described herein may be made without departing from the invention as set forth in the appended claims.

Claims

1. An dual-function joystick for use in electronic video games comprising:
 - a) a frame adapted to be mounted to a game cabinet;
 - b) a control shaft mounted in said frame for multidirectional pivotal movement therein, said control shaft including a first handle end, to permit input by a game player and a distal end remote from the handle end;
 - c) means for securing said control shaft in

said frame including an elastomeric grommet, having a centrally located aperture to accommodate passage of said control shaft therethrough, said grommet being secured to said frame, said grommet serving to center said control shaft in the absence of player input; 5

d) means for detecting the position of the distal end of said control shaft and for generating a unique digital output code corresponding to each discrete joystick position. 10

2. The joystick of claim 1 wherein said means for securing said control shaft further includes: 15

a) an annular spacer having an aperture, concentrically disposed around said control shaft, for retaining said control shaft in said grommet aperture;

b) means for securing said spacer to said control shaft. 20

3. The joystick of claim 2 wherein said means for securing said spacer to said control shaft includes a "c"-ring disposed in an annular recess around the circumference of said control shaft. 25

4. The joystick of claim 1 wherein said detecting means includes: 30

a) a pair of slidable members operatively coupled to said distal end and carrying a plurality of optical masking fins thereon;

b) means for supporting said slidable members for reciprocating motion in orthogonal directions relative to each other, and; 35

c) a plurality of optical switches mounted to said frame, each disposed along the path of a corresponding optical masking fin, said optical switches having output circuitry for providing an output indicative of whether said optical switch is blocked by said optical masking fin. 40

5. The joystick of claim 4 wherein said means for supporting comprises a rectangular carriage having a groove along each side, each pair of grooves on opposing sides of the rectangle receiving one of said slidable members for slidable motion therein. 45 50

6. The joystick of claim 1 wherein said detecting means includes:

a) a pair of slidable members operatively coupled to said distal end; 55

b) a rectangular carriage, for supporting said slidable members for reciprocating motion in orthogonal directions relative to each

other, said carriage having a groove along each side, each pair of grooves on opposing sides of the rectangle receiving one of said slidable members for slidable motion therein.

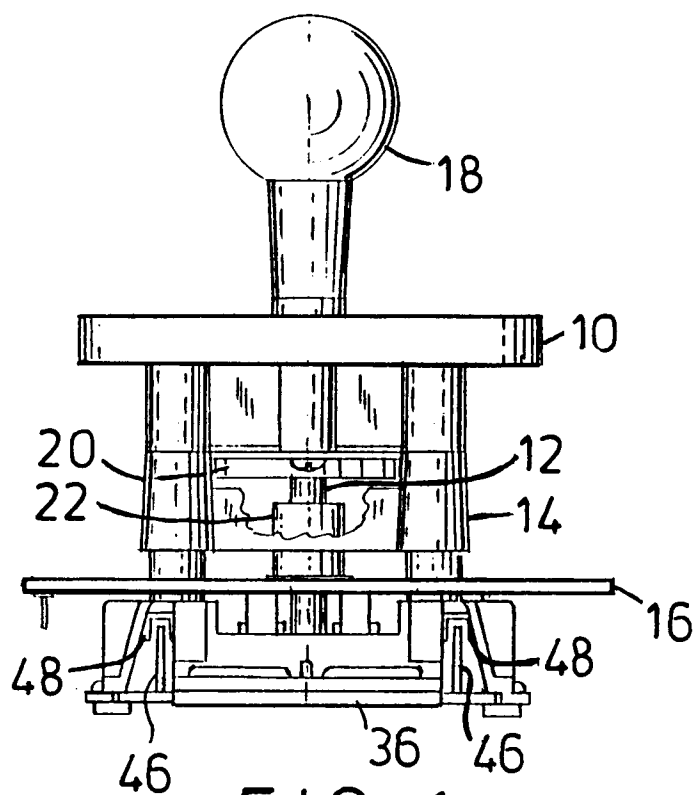


FIG. 1

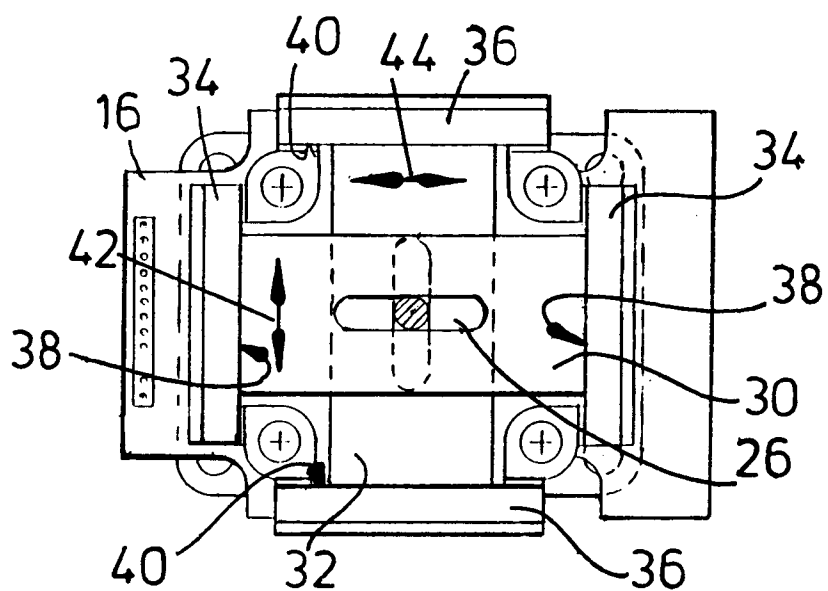


FIG. 2

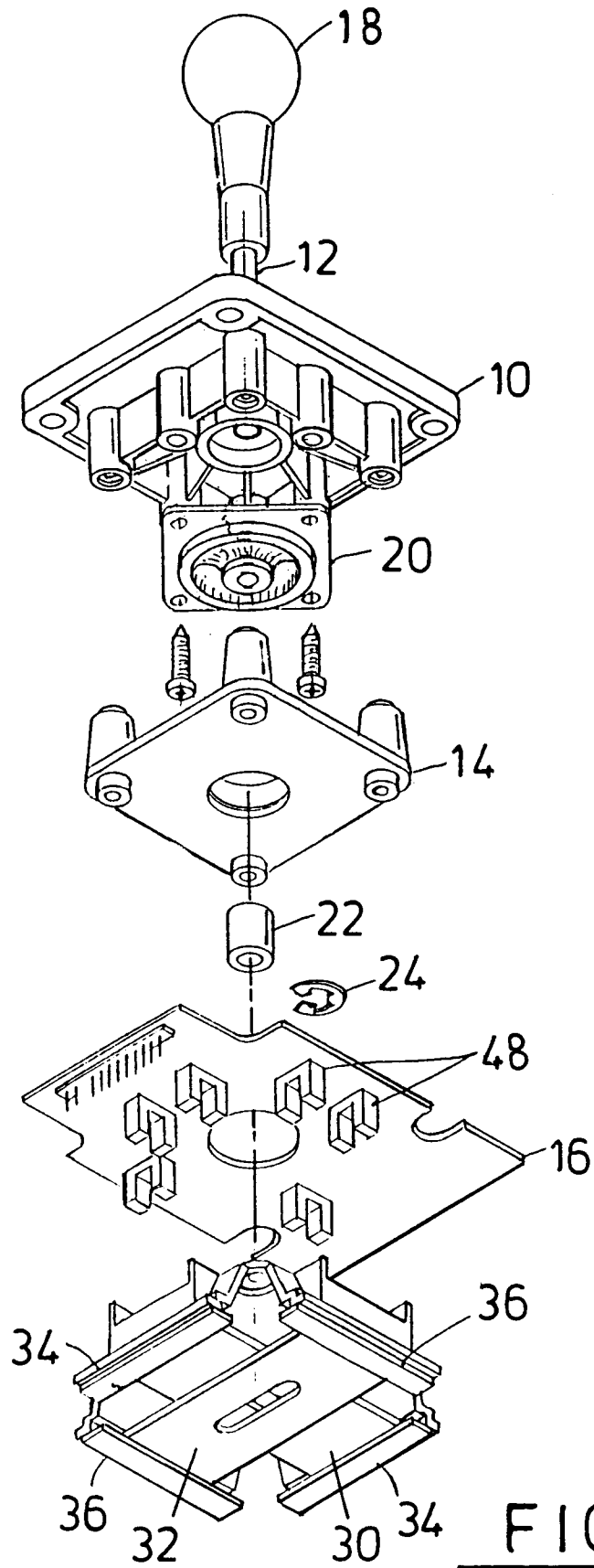


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 91303227.2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
P, X	US - A - 4 958 071 (SCOTT) * Claims 1,16; fig. 1-12 *	1, 4, 6	G 01 D 5/34 G 05 G 9/04 G 06 K 11/08 A 63 B 71/04
A	--	2, 3, 5	
A	US - A - 4 731 530 (MIKAN) * Abstract; fig. 1-3, 6 *	1, 4, 6	
	--		
P, A	US - A - 4 994 669 (STERN) * Claim 1; fig. 1 *	1, 4, 6	
	--		
A	GB - A - 2 125 947 (SUNCOM) * Abstract; fig. 2 *	1	

			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G 01 D G 05 G G 06 K A 63 B G 06 F
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
VIENNA	10-10-1991	MIHATSEK	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	